North Dakota Agricultural Experiment Station

The Work of the Experiment Station

REPORT OF DIRECTOR

Thomas P. Cooper

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Agricultural College, North Dakota
January, 1916

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*Detailed to North Dakota Experiment Station by the United States Department of Agriculture.

THE WORK OF THE EXPERIMENT STATION

REPORT OF THE DIRECTOR

1915*

Thomas P. Cooper

The function of an Agricultural Experiment Station is to acquire information through investigation and experiment. The information thus acquired is for the benefit of agriculture, and primarily to promote the economic status of that industry. The science and the practice of agriculture must be increasingly based upon the results of research work. Such work is the foundation upon which a progressive and successful agriculture rests.

It is at times suggested that agricultural research work is divided into two fields, that of production and that of distribution. Popular opinion often assumes that the one field is particularly the realm of the Experiment Station and that the other pertains to business, also that the latter relates to the economics of agriculture while the former does not. The research and investigational work of an Experiment Station is essentially economic, as the development of the knowledge obtained and its application affects to a greater or less extent both the agricultural practice and the returns from the farm.

The origination of new and superior forms of plant life, the development of methods to free plants or animals from disease, the determination of profitable or unprofitable methods and practices, or the discovery of the principles underlying some of the baffling soil problems, may as profoundly affect the returns from the farm as will an increase in the price of its products.

The farm owner determines the extent to which he will use the information made available by the Experiment Station. He decides upon the method of agriculture to be followed upon his farm. Increasing the profits on an individual farm in the state is the problem of each farm owner, and increasing the returns from the farms of the state as a whole is the problem of the Experiment Station. There are at least two methods by which the income of the farm may be increased:—the first through efficient farm practice and organization; the second by securing increased prices for the products. The first method of increasing income is in the hands of the farmer. The second method is a world problem which the individual affects but slightly. Higher returns may be secured by farmers for their commodities through organization and the standardization of the products.

*Twenty-sixth annual report—fiscal year ending June 30, 1915.

Farm profits are ordinarily affected to the greatest extent, however, by the individual practices and methods of the farmer. He determines his farm organization, the efficiency of operation and the methods of production which shall be used. Farm land may be built up or run down, poor or good rotations may be used; dairy cows may be kept at a profit or "boarder" cows maintained. The development of each phase of farm operation is dependent upon the individual. Experiment Station results may aid the individual in improving the conditions upon his farm and give him a basis of exact information. The Station cannot go farther, however, than to point the way and show the methods. To render the accomplishment a fact, the farmer must make use of the information and results made available.

The North Dakota Experiment Station through its various activities, attempts to determine and to point the way to a more profitable agriculture in the state, and to protect the agriculture of the region from features that would be disastrous. Its studies and investigations are concentrated upon problems which do or may confront large groups of farmers. These problems are essentially economic in that they ultimately affect the profits of the farm. The greater number of investigations undertaken to date have had for their object the determination of practices profitable and unprofitable, and the making of discoveries in plant or animal life which will increase the production per unit of labor or land that is to be utilized.

INFORMATION ON PROBLEMS RELATED TO THE FARM

Information is also needed on many problems with which the farmer comes in contact, that is with problems that are not primarily agricultural. Accurate information relative to rural finance, markets, and organization is required if the best development of agriculture in the state is to take place. Poor methods of finance, of marketing, or of rural organization may lose the farmer as much as do poor varieties of grain or unprofitable classes of livestock.

There is a wide spread interest in many of the phases of farm operation as related to business. Too little attention has been given these relationships by Experiment Stations, and an investigation of the possibilities is necessary. Undoubtedly certain general principles govern the successful forms of co-operative enterprise and should determine economic legislation pertaining to the agricultural industry. The Experiment Station should be prepared to study the situation and make plain the principles which will bring about the most successful community welfare. Development of such studies requires much time and special funds should be provided for investigations of this character. It is time that organized research should attack the problems which concern the farmer and his relationship to other industries and professions.

RESEARCH WORK OF THE EXPERIMENT STATION

A brief statement is given in the following pages of the more important lines of research in progress at the Experiment Station. The

projects of work are not discussed fully, nor is any attempt made to cover all lines of work in progress. As rapidly as results of research and trial justify it, the material is published as circulars or bulletins that detail the experiment and its application.

SWAMP FEVER

The investigations of swamp fever in horses have been continued. During the year all experiments relating to immunity reactions carried on previously were repeated for checking purposes. The results were practically identical to the ones previously obtained. New experiments have been planned with a view of approaching the diagnosis problem from a different angle.

Trials were made with the arsenico-mercuric treatment proposed by Boulin. The trials showed conclusively that this treatment fails to eradicate the disease producing agent from the infected animal and must be looked upon as worthless in our form of the disease.

A new phase of the swamp fever problem presented by Seyderhelms, whose investigations led him to conclude that the disease is due to a toxic agent associated with the larva of the bot fly, has been taken up with a view of obtaining confirmation or rejection of this theory. In one case, ten bot fly larva removed from a field case of swamp fever were crushed in a physiological salt solution. This mixture was injected intravenously into experimental horse No. 2612. The animal in spite of very severe reaction, did not succumb nor did it show any marked temperature action or anemia during the four months the subject was kept under observation. Its post-mortem appearance, however, resembled those seen in swamp fever. Blood drawn from this horse about two weeks before its destruction, as well as that drawn immediately before, proved to be virulent to experimental horses. In all particulars, the clinical as well as the patho-anatomical aspects of those cases resembled those seen in our artifically induced swamp fever cases. Blood drawn from the experimental horses infected by blood from No. 2612, infected in a similar manner experimental horse No. 3090. The results which have been obtained in this work seem to justify further experiments along this line.

It is of interest to observe the tenacity with which the virus persists in cases of swamp fever which have apparently recovered. The blood of an experimental horse which was infected in 1908, and to all appearances recovered, produced the usual febrile reactions in a healthy experimental horse in 1915. There seems to be, however, a tendency for the incubation period to lengthen.

INVESTIGATIONS IN HOG CHOLERA

The close of the fiscal year found the preliminary work connected with this project practically completed. Hereafter the investigation will be concerned primarily with some of the problems associated with the disease. The preliminary investigations were made necessary by failure to produce a thoroughly potent serum during the period of 1910-13.

Therefore, it was imperative to have the certainty of being able to obtain the same favorable results in serum production as were obtained elsewhere before the more difficult phases of the work could be dealt with. With the same equipment, materials and methods as were used previous to July 1st, 1913, potent serum has been made constantly since that date. Since that date all serum produced has been potent and high in quality. A full report of the details of this work will be made in future specific publications.

An interesting result obtained as a by-product of the investigation is the influence of the time of bleeding upon the protective value of the serum.

The method followed was to hyperimmunize a hog at a given time, bleed it from the tail two weeks after hyperimmunization, again a week later, once more after the lapse of a week, and final bleed after another week. This gave four bleedings, the last one taking place five weeks after the hyperimmunizing.

A separate sample was retained of each bleeding, and the potency of the sample tested by itself. In the tests two pigs were used, one receiving 0.4 c.c. per pound (1 D.) body weight, and the other 0.2 c.c ($\frac{1}{2}$D.), while at the same time two c.c. of active virus was given. The test pigs so treated were carefully observed for three weeks after the injection and records made of the temperature and appetite. The latter was graded as follows: xxx (3) when the pig was anxious for his feed and remained at the trough as long as the feed lasted; xx (2) when the animal came to the trough, but retired before the meal was finished; x (1) when the pig came to the trough at feeding time but failed to eat, and ° (0) when the pig could not be induced to come to the trough at all.

An arbitrary method of classifying the potency of the serum according to the manner in which the test pig was protected by it, was used. A serum was classed xxx (3) when no evidence of disease became apparent; xx (2) when there was a sustained temperature action without loss of appetite or when there was loss of appetite without temperature reaction, recovery following; x (1) when there was a temperature accompanied by loss of appetite, recovery following during the test period; ° (0) when there was sickness and death.

In the following table the results of those tests are shown in summary and by averages:

SUMMARY OF RESULTS OF SERUM TESTS BY BLEEDING DURING YEAR 1914–1915

Hyper-immune No.	1st bleeding		2d bleeding		3d bleeding		4th bleeding		Remarks
	1 D.	½ D.	1 D.	½ D.	1 D.	½ D.	1 D.	½ D.	
45	2	0	2	2	3	0	3	0	
51	3	3	2	0	2	0	3	0	
93	3	3	3	2	3	2	3	0	
96	3	3	3	3	3	3	3	2	
99	..	..	2	0	0	0	3	3	Pig sick, not bled 1st time
103	3	3	3	3	3	3	2	0	
124	3	3	3	3	3	2	3	0	
138	3	0	3	0	3	2	2	0	
141	3	2	..	..	3	0	..	..	Pig sick 2d bleed, final 3d.
185	3	3	3	3	3	3	0	0	
198	3	3	3	3	0	2	0	0	
200	3	3	3	3	3	2	3	0	
224	3	0	3	3	2	0	2	0	
275	3	3	3	3	3	3	3	3	
278–297	3	3	2	2	2	0	2	0	
290–270	0	2	3	3	2	2	3	3	
373–322	3	3	3	2	0	2	2	0	
491–643	3	2	2	2	3	3	3	3	
510	..	..	..	..	3	3	..	..	Without tail
511–588	3	3	3	3	3	3	3	3	
623–624	3	2	2	2	3	3	2	0	
641–398	3	3	3	3	3	3	3	3	
652	3	3	3	3	3	3	3	3	
Potency Average	2.809	2.380	2.714	2.285	2.434	1.913	2.423	0.952	
Av. Wt. lbs. Test Pigs	50.6	58.4	53.3	60.0	55.6	59.7	49.5	55.8	

Note:—The above table indicates according to arbitrary standards the potency of serum obtained from a series of four bleedings as determined from a full dose (1 D.) and half dose (½ D.)

DISTRIBUTION OF SERUM AND TOXINS

During the period beginning August 15, 1914, and ending June 30, 1915, the Station made one thousand two hundred and seventy issues of materials representing the following amounts:

Subcutaneous tuberculin	20,999 c. c.
Intradermal tuberculin	1,236 doses
Avian tuberculin	500 doses
Pasteur subcutaneous mallein	2,631 c. c.
Ophthalmic mallein	11,033 doses
Hog cholera protective serum	1,224,306 c. c.

A beginning was made with the manufacture of mallein and our product was tried out by various assistant state veterinarians in the course of their field work. Henceforth, mallein manufactured by the Station only will be issued.

The occurrence of hog cholera in certain sections of the state and the demand for serum to which the outbreaks gave rise, made it very apparent that the funds available for serum distribution ($3,000.00 per annum) were far from sufficient.

In order to meet the situation, the Board of Trustees issued warrants for the purpose of purchasing serum. From the funds thus supplied, a quantity of serum was purchased to be issued to those in need of it at the cost of purchase. To the serum bought was added such serum as had, from time to time, accumulated as a by-product of the research work on hog cholera carried on by the Experiment Station. No charges were made for the serum thus added to the general stock. The price of the serum thus covered the price of purchase plus the interest on the loan minus the free serum added.

All serum was purchased subject to our own test, and no mixed serum was shipped until after its potency and freedom from harmful factors were proven by a thorough test. The costs of testing, storage, bottling and packing were borne by the Serum Institute out of the funds appropriated for its maintenance.

This plan has given satisfaction and under its operation all demands for serum have been met promptly, and a material of proven potency supplied at prices at least as low as those current in states where much larger appropriations are available for the purpose.

SOIL SURVEY

The Soil Survey is conducted for the purpose of securing definite information regarding the value of the soils of the state and their suitability for the production of the various crops. It furnishes a knowledge of the characteristics of the soil on every farm in the area that is surveyed. The relationship and the crop producing power of the different soil types is studied and the results secured on the one soil type when properly interpreted may in some instances be applied to the development of similar soils. Soil surveys have been in progress in LaMoure, Dickey, and Bottineau Counties during the year. The field work in LaMoure County was completed early in August, 1914, and the work in Dickey County the latter part of November, 1914.

The greater part of the area of LaMoure and Dickey Counties is occupied by soils of glacial origin. The soils which are not of direct glacial origin are formed largely from re-worked glacial material. The soils comprising the re-worked glacial material, with the exception of the better river and lake bottoms, are of less agricultural value than the soils of direct glacial origin. Analyses of representative samples of the various soil types of LaMoure County show a comparatively high water-holding capacity. The constituent elements of fertility necessary to plant growth are high in the prevailing soil types. Analyses indicate, however, that attention must soon be given to the maintenance of the phosphorus content of the soil if productivity is to be maintained at a high level. The investigations indicate at the present time that phosphorus may soon become one of the limiting factors in crop production.

The problem of the phosphorus content of the soil assumes a new aspect in this territory of comparatively low rainfall, as it differs from the more humid regions. The question arises as to whether phosphorus becomes liberated at the same rate in this district as in districts where rainfall is greater.

There is considerable variation in the soils of the counties. In La-Moure County, some thirty types or phases of soil were recognized and mapped. In Dickey, there were some forty soil types or phases. Each of the phases or types of soil has its particular soil problem. The working out of their boundaries and determination of their values will aid materially in applying systems of soil management that will return the greatest profit. The Soil Survey is carried on in co-operation with the County and the Bureau of Soils of the U. S. Department of Agriculture.

RODENT CONTROL

In 1914, a co-operative arrangement was affected with the Biological Survey of the U. S. Department of Agriculture for a study of methods of control and extermination of ground squirrels, pocket gophers, prairie dogs, and other rodent pests occurring in the state. Because of the damage caused by the flicker-tail or Richardson ground squirrel, and since no satisfactory method had been discovered for its control, the first experimental work under the Agricultural Experiment Station was undertaken upon this species. This work was started near Bottineau in April, 1914, and an extended series of experiments was conducted there and at other places in the state until September, 1914. The experimental investigations developed a method of control and extermination which field tests showed to be especially efficient and economical. This method was published in Experiment Station Circular No. 4.

The 1915 legislature appropriated a revolving fund of $3,500.00 to enable the Experiment Station to co-operate with counties, townships, and farmers' organizations in conducting systematic extermination campaigns against these rodents. Plans were perfected to present the method to persons living in the infested areas of the state by means of field demonstrations financed by the Agricultural Extension Department. Two experienced men were engaged upon this work from early in May, 1915, to July of the same year. Two additional men were similarly employed during the month of June. These men met with gatherings of interested persons throughout the entire infested area of the state, and demonstrated the method of preparing the poisoned grain. They explained and demonstrated the manner of using it to destroy the ground squirrels without injuring domestic animals. One hundred and eighty field demonstrations were carried on in this manner.

Following the demonstrations, extermination campaigns were undertaken in many parts of the state. County Commissioners, Township Supervisors, Farmers' Clubs, Commercial Clubs, and progressive citizens co-operated in developing this work. In the demonstrations and in the organization of these campaigns, the County Agricultural Agents rendered especially effective service. The effectiveness and economy of the method used were so evident that heavy demands arose for large quantities of the poison materials. Owing to the difficulty of procuring locally sufficient strychnine alkaloid and saccharine to meet the demand, the Experiment Station effected arrangements with druggists to bring the supplies into the state in large quantities and distribute it at cost. In this way the demand was met and all orders were filled promptly up

to July 1st, 1915. A total of 4,608 ounces of strychnine alkaloid was distributed through local druggists at from 60c to 80c an ounce. Six hundred ounces of saccharine was distributed in the same manner.

The experience of this year in extermination has been so satisfactory that detailed plans are being prepared to conduct systematically organized extermination campaigns over large areas during April, May and June of 1916. Several counties through action of their Board of Commissioners have provided funds for this purpose. Arrangements are being made during the winter to insure an adequate supply of the poison materials.

As a part of the co-operative agreement with the North Dakota Experiment Station, the U. S. Biological Survey employed a squad of six men during the summer to exterminate the flicker-tail or Richardson ground squirrel on the Fort Totten Indian Reservation. This was done in order that the government land might not serve as a breeding ground to infest privately owned lands. The success of this work has been a striking demonstration of how effectively these pests may be exterminated when large areas are systematically poisoned by the methods which have been recommended.

Effective methods of controlling and exterminating the pocket gophers and prairie dogs have also been tested thoroughly and published in circular No. 4 of the Experiment Station.

INSECT CONTROL

The relation of insects to agricultural production is increasing in importance in North Dakota. Definite Experiment Station projects have been organized for the investigation of insect conditions as they affect or threaten crops and livestock. These trials are designed to determine remedial measures for their control. Especial attention during this next year will be given to the Hessian fly, plant lice, canker worm, blood-sucking horse fly, and bot flies.

HORTICULTURAL WORK

During the past year, experimental work in horticulture has been carried on under the following projects:—Tomato breeding, Variety testing, Cultural experiments, Cultural experiments with greenhouse tomatoes, and Farm garden. The tomato breeding work was begun in 1914 with a view to producing better quality, earlier ripening and higher yielding strains of tomatoes suitable to North Dakota. There is a possibility of developing a local canning industry for the purpose of handling tomatoes and other vegetables, providing superior varieties can be produced in the state.

Most of the early varieties of tomatoes are rough and of inferior quality, and those which are smooth and globular contain a comparatively small proportion of meat. The strain of tomatoes which the Station hopes to develop is one which will rectify the poor qualities of the early strains. The late frosts in June, 1915, killed all plants that were being used and work was discontinued until the winter season when the green-house will be used to gain a year's breeding work.

VARIETY TESTING:

Much work in variety testing has been carried on to determine the best early and late strains of cabbage, cauliflower, celery, sweet corn, squash, onion, radish, lettuce, and other vegetables. The results obtained from the work with cabbages were published as an appendix to Circular 5. Preparations are being made to develop work in the breeding of sweet corn and in the further test of varieties.

CULTURAL EXPERIMENTS:

A number of cultural experiments, including fall seeding and mulch trials were instituted with several different vegetables. The primary purpose was to determine the effect of different methods of cultivation, of mulching, and the effect of fall seeding. A number of the treatments have shown promise, although it is too early at this time to consider any results as conclusive. Fall sown vegetables, onions, lettuce, spinach, beets and chard, yielded products fit for the table about ten days earlier than spring sown vegetables. All produced a good stand, with the exception of radish. Apparently the fall sowing of the vegetables mentioned is a good method of securing early vegetables for home use.

An experimental asparagus planting was started for the purpose of determining the importance of depth of planting, the use of winter mulches as compared with the permanent mulch, and the length of the cutting season.

GREEN-HOUSE WORK:

In the winter of 1913-1914, the green-house tomato crop was a total loss on account of blossom-end rot. A number of trials were started with the hope of finding some clew to a treatment which would avoid the disease. These tests included the sterilization of the soil with steam and formaldehyde, the use of virgin soil, and the use of green-house soil manured and not manured. The experiment run for one winter only is too short to give conclusive results, but the data obtained seems to indicate that both the steam and formaldehyde sterilization tended to increase the amount of disease.

WORK WITH SMALL FRUITS:

A large number of strains and varieties of strawberries are being tried out to give definite information concerning their comparative merits. This experiment also has for its purpose the determination of the importance of the so-called pedigree strains. There is some matter of doubt as to the importance of the so-called pedigree strains because of the fact that strawberries are reproduced asexually. The new work with fruits comprises plantings of seedling plums, raspberries, strawberries and grapes, and some seedling strawberries. More extended work with bush fruits and shrubbery for ornamental planting is contemplated for the immediate future.

SUGAR BEETS

A four years' study of sugar beets and the value of different varieties was completed by the publication of the 1914 results. The study

has shown conclusively that sugar beets of high sugar content may be produced in the state. Soil and climatic conditions in the western area of the state are admirably adapted to the production of a beet of quality. The eastern part of the state, however, is not as well adapted to the production of a beet carrying a high sugar content. Sugar beet production is not an economic enterprise in the state at the present time, although increased population, and changes in conditions which surround the beet sugar industry may make their production profitable in the future.

FEEDING VALUE OF CORN AT DIFFERENT STAGES OF GROWTH

The project begun in 1914 to determine the feeding value of corn at different stages of growth has been continued. The analytical data obtained in 1914 showed a gradual increase in the amount of dry matter and its approximate constituents from one stage of cutting of the corn to another. When this qualitative change was applied to the acre basis to ascertain the total yield of each constituent, there seemed to be a decrease of dry matter as the crop matured. Several adverse factors entered into this work, and this coupled with either poor sampling or poor stands was thought to have affected the data sufficiently to demand a continuance of the work. In this trial the gradual increase of the dry matter and the relative proportion of its various constituents was much less noticeable than for other trials of a similar character, such as have been reported by Ladd at Geneva, N. Y., and by Houston and Jones at Purdue, Indiana. The information that may be obtained from this project is of great importance, especially as a large number of silos are being constructed in the state and as more use will be made of the entire corn plant. A determination of the feeding value at its different stages may largely determine the types of corn that will be best adapted for silage purposes in the different sections of North Dakota.

SOIL STUDIES

A study of the soil problem under the Adams project has been continued. One-half year's time of the soil chemist is devoted to this work. The progress on this project has been primarily confined to the securing of data fundamental to the development of the problem. Among other interesting features taken up has been that of the differences in the nitrogen and phosphorus content of the Experiment Station rotation plots. These have been compared with a plot which has grown wheat continuously for thirty-three years and a plot of virgin sod. A large amount of data has been secured and tabulated, and graphs have been drawn to represent the comparison of the continuous wheat plot and the plot of virgin soil with the average of a group of selected fertile soils. It is significant that there is a great difference between the soil of the continuous wheat plot and that from the virgin sod. If it may be assumed that the soil on both plots was originally about the same in composition, the surface soil of the continuous wheat plot is now in a condition comparable to the sub-surface of the virgin sod. In

other words, the constant cropping to which the continuous wheat plot has been subjected has depleted the fertility of the surface soil so that it is now about as fertile as the sub-surface was originally. In connection with this, evidence is accumulating to show that the continuous cropping is tending to bring about an acidity of the soil that may within a few years seriously affect the cropping conditions.

PAINT, OIL AND VARNISH STUDIES

The paint tests that have been in progress for several years have been continued. The chief studies during the past year have included formula studies, the effect of emulsifiers upon the wearing and keeping qualities of paints, together with extensive tests of the value of mineral thinners. The practical exposure tests as based upon test fences, commenced in 1906, were completed this year. Summarized, the results indicate: First, that the use of the ordinary ochre of commerce has proven a failure as a primer in every test where it has been used. Second, the colored paints used in this test show decidedly better wearing qualities than the same formulas untinted. The gray or yellow average about two years longer wear than the white paints of the same formula. The better wearing qualities are due to the fact that the colored paints are acted upon to a less extent by the actinic rays of the sun than is the white paint. Third, paints applied on white pine are in much better condition than the same paint applied on cedar, while, when applied to hard pine they are without exception in much poorer condition than on the other woods. This would indicate that these woods require special treatment for their successful painting. Fourth, several low grade paints were included in the test. These cheap paints failed completely, as they were badly disintegrated before two years had elapsed. The results show clearly that it is poor economy to purchase a paint which is not manufactured and guaranteed by a reputable company.

Oil studies have been carried on chiefly with the Soya bean and with linseed oil. A large number of samples of Soya beans have been pressed for their oils and the oil analyzed. The oil from the Soya bean is one of the most promising substitutes that have thus far been found for linseed oil.

Studies are in progress to determine the influence of various factors in changing the properties of linseed oil. This includes the influence of immature seed, frosted seed, bin-burned seed, frozen seed, and seed affected by disease. It is expected that this work may indicate the proportionate values of such seed as compared with the best grades of linseed.

MILLING TESTS OF WHEAT

A study of the different types of wheat as to milling value has been made in co-operation with the Office of Grain Standardization of the U. S. Department of Agriculture, Bureau of Plant Industry. During the year, four hundred samples have been examined and tested. Comparisons have been made between the Marquis, Bluestem, Fife, Velvet

Chaff, Durum, and the so-called Red Berry Durum wheat. The Marquis wheat has made a good showing, having averaged fully as good as samples of Fife and Bluestem. The work with Velvet Chaff has indicated that the comparative value for flour-making purposes is much nearer that of the Fife and Bluestem than is generally supposed. The Red Berry Durum has shown very little value as a bread wheat. This work has undoubtedly been productive of good results to the grain growers of the state in bringing about a more nearly equitable classification of Velvet Chaff and Durum wheat. The present spread between the Velvet Chaff and the hard spring wheats seldom exceeds one-half cent, while the Durum wheat commands a price practically the same as that received for the hard spring wheats. The milling work has been a great assistance in preventing the introduction and spread of freak wheats. The material that is being collected from these analyses from year to year should finally lead to changes in our present system of grading grains, placing grading upon the basis of real and potential values of the grain rather than upon arbitrary standards.

WHEAT AND FLOUR STUDIES

Wheat and flour studies have been developed in co-operation with the Office of Grain Standardization to determine the value of various factors influencing the commercial grades of grain. An additional sidelight upon this problem is being carried out by the North Dakota Station to determine the comparative value of wheat and the causes of quality variation. This work should be effective eventually in determining the basis for grain standards. The work now is largely concerned with technical and abstract studies. Much time and work has been expended in developing information as to what constitutes quality in wheat. This has involved a study of the soluble constituents of the wheat kernel and the relation of the quantity of such constituents to quality. The results obtained at present show a higher proportion of soluble material in sprouting wheat and its products, and indicate a method of determining the extent to which certain natural changes have progressed. Measurements were also made of the value of flours obtained from the mixture of foreign seeds and wheat, and of flour which had been otherwise damaged, as by bin-burning and frosting. This work is not as yet completed and is to be continued during the coming year. An interesting feature of this study was the attempt to determine the variation in quality of flour from different parts of the kernel, and the natural causes for the differences in the quality found in wheat due to enzymes or some other cause. Progress has been made along this line and results will probably be published during the coming year.

REGULATORY WORK

During the past year, twelve special food bulletins, one paint bulletin, and one bulletin containing a compilation of the food laws revised and brought up to July, 1915, were issued. Plans have been prepared for sanitary slaughter houses. These plans are now being adopted as new slaughter houses are erected.

Bacteriological and chemical examinations in several instances showed the unsanitary condition of milk, as well as that of the water supply which was being used in connection with the dairy. Much has been accomplished in improving the sanitary conditions of food handling establishments. This has been mainly through individual work and correspondence, by inspections of towns as a unit, and through attempts to awaken interest and increase civic pride in the community. These efforts in the end must tell for better sanitary conditions in all towns, and the influence should spread from the towns into the country. Standards have been prepared for the various macaroni products which will tend to improve greatly the character of much of the American manufactured macaroni, and should bring a greater demand for Durum wheat. Macaroni of the best quality can only be made from high grade Durum wheat. With the increased demand for high grade and pure Durum wheat, we may expect that this crop will come to be more generally grown in the state.

ROOT AND SEED INFECTING DISEASES OF CEREAL GRAINS AND GRASSES

This project was begun primarily to establish the relationship of imperfect fungi to cereal grains and grasses, and the methods of cropping the land with a view to establishing a means of preventing infection and continuation in the sod or the soil. The project has been carried on chiefly in fields and plots where special attention has been given to various methods of handling the seed and soil and of plant selection with a view to obtaining strains of standard varieties which have some special resistance to the rusts and fusarial blights.

Among other features given a trial for possible effects upon soil or plant was the use of an inoculation material advocated by a company as valuable in applying beneficial bacteria to old and worn soils. It was assumed that through the application of this culture results could be obtained similar to those secured from the inoculation of the soil for a clover or alfalfa crop. The company furnished cultures which had been placed upon the seed in the various ways recommended by the company, the seed being treated before being planted. Wheat, oats, rye and barley were sown upon plots of equal size and condition with treated and with untreated seed. There was no material visible difference between the treated and untreated plots during any part of the growing season. The harvesting of the crops showed the following results:

EFFECT OF "INOCULINE" UPON THE DEVELOPMENT OF WHEAT, RYE, OATS AND BARLEY

Exp. No.	Kind of Crop	Kind of Treatment	Weight of Grain produced
460	Wheat	Check—Untreated	32.5 lbs.
468	"	Treated with Mixture of "Oat", "Rye" and "Barley" Culture	32.75 "
469	"	Treated with "Oats" germ. only	43.25 "
470	"	Treated with "Rye" germ. only	31.75 "
471	"	Treated with "Barley" germ. only	32.75 "
461	Oats	Check	59.75 "
465	"	Treated with "Oat" germ. only	54 "

462	Rye	Check	23 ⅛ "
466	"	Treated with "Rye" germ. only	18.75 "
463	Barley	Check	39.25 "
467	"	Treated with "Barley" germ. only	39. "

The results of this test, so far as the soil is concerned, were convincing and showed that the application of this inoculating material to oats, rye, wheat or barley has no value. The soils upon which these trials were conducted have been rather continuously under cereal culture for a period of about thirty-five years.

QUACK GRASS

A test was made of the effect of strong solutions of potash in the control of quack grass. It was hoped that this substance could be used in sufficient strength to treat the quack grass and yet due to its quick leaching, have no effect upon the soil to prevent crop production in the future. Known amounts of the flake potash were applied directly in contact with the quack grass. These applications were made at various rates of strength, the heaviest being equal to 16,000 pounds per acre. This application was apparently strong enough to kill the quack grass on the surface of the ground. It was not strong enough, however, to prevent the final growth of the grass from the lower root stalks. The growth was only partially checked. Such method of destruction is uneconomical, and like many other methods depending upon the application of chemicals, will not be of importance as the cost of chemicals is too great.

FLAX DISEASE INVESTIGATIONS

The object of this project is to gain knowledge of the origin, cause and distribution of the flax diseases which affect the soil and seed. Much work has been conducted on the field plots. Special lines of centgener planting were conducted and trials of cross breeding work continued to increase disease resistance, particularly in regard to rust and wilt. The progress made this year has been very encouraging. It seems evident that resistance in the plants can be developed to such an extent as to practically control these diseases. Several trials have been made of seeds sent in by farmers to be tested relative to their powers of resistance to disease as shown by tests upon flax-sick soil. These tests seem to indicate that the resistant power when once accumulated endures for some period of time, even though the crop may be grown upon land which is free from disease. The seed, however, will tend to disintegrate in its powers of resistance when allowed to become wet, mouldy, or partially injured by freezing and thawing.

ACTIVITIES OF THE MICRO-ORGANISMS OF THE SOIL

This project, which has for its purpose a study of the factors which accelerate or retard the action of micro-organisms upon the liberation and accumulation of available plant food within the soil, has been continued. The chief object of this investigation at present is to determine

and control the optimum conditions for the maximum efficiency of micro-organisms in soil fertility. The work for the past year has demonstrated that "energy material", namely, the organic matter which upon its decomposition yields energy to the decaying micro-organisms, is the chief factor governing ammonification. The energy material consists chiefly of carbohydrates and its decomposition products, although the carbon radical of the protein molecule may furnish considerable energy. So long as the readily available energy material is in excess of the proportion of the energy material to nitrogen required by ammonifying organisms, a minimum amount of ammonia will be accumulated within the medium. The amount of ammonia accumulated under these conditions will be governed by the organism's ability to exhaust the ammonia present. On the contrary, when the readily available energy material falls below the proportion of energy material to nitrogen required by ammonifying organisms, the phenomena of ammonification will take place, although there is no doubt but that if the energy material becomes too low the ammonifying phenomena may almost, if not entirely, cease. Aside from certain physical and chemical factors necessary, the ammonifying phenomena is governed by the energy material present. This investigation is fundamental in its application to our soil problems and its present progress indicates that the nitrogen ratio of the soil flora makes ammonification an exceedingly doubtful criterion for measuring soil fertility. Present methods for measuring a soil's ammonifying powers are relatively unreliable because the energy factor is not comparable. The data and conclusions on this work will be published during the coming year.

INVESTIGATIONS OF POTATO DISEASES

Potato production is becoming increasingly important in North Dakota. The state is peculiarly adapted to the production of a high class seed potato that is in demand in the southern states. During the past few years, however, the older sections of the state have developed a considerable number of diseases which may materially affect the future of this industry.

The following diseases have been found of economic importance in the state: Fusarium Wilt, Fusarium Rot, Brown Stem Rot, Rhizoctonia, and Leaf Roll. A brief survey was made of the potato crop in the eastern part of the state. A considerable amount of disease was found throughout the Red River Valley, and the lighter soils just west of it. The Fusarium Wilt, Verticilium Wilt, Rhizoctonia, and Brown Stem Rot appeared to be the more active diseases in the lighter soil areas. The Early Blight was found very extensive in the region of the heavier soils. The lighter soils proved to be almost free from the disease. The frequent occurrence of Rhizoctonia on potato vines growing from well treated seed and on practically new potato soil, led to the study of the soil for the distribution of that organism. Samples of soil collected from twenty-four plots devoted to crop rotation during the past twenty-four years were tested by cultural methods in the laboratory. Four samples were taken from each plot. Of the twenty-four plots, eighteen contained the sterile stage of corticicum vagum, or Rhizoctonia. Many of the plots

tested had not been cropped to potatoes for many years. From this wide distribution of Rhizoctonia two inferences may be drawn; namely, that Rhizoctonia grows on the roots and debris of a large variety of plants, and that the present method of treating seed potatoes to avoid the disease is to that extent futile.

PURE SEED LAW

The work of the Seed Laboratory established at the North Dakota Experiment Station by legislative act, has continued to develop in accordance with the statutory provisions. The past year, as in previous years, the chief attention has been given to seed analysis and to inspecting such plots as applications from growers demanded. During the current year, three thousand nine hundred and ninety-four samples of seed were examined in the laboratory.

CLASSIFICATION OF SEED SAMPLES EXAMINED JULY 1, 1913, to JUNE 30, 1915

Submitted for identification	72
Field seeds submitted for purity and germination tests	2,527
Field seeds submitted for germination tests	781
Garden seeds submitted for germination tests	600
Samples collected by inspectors	14

The seeds most commonly represented were: alfalfa, 540 samples; Brome grass, 479; corn, 706; wheat, 434. The samples which were collected by the inspectors were packages of lawn grass. No general inspection of seedsmen was made on account of lack of funds, and only such inspection of stored grains was made as seemed necessary to take care of such specific cases as arose from controversy. Prohibited seeds were found in two hundred and forty-five samples, consisting chiefly of quack grass in Brome grass seed, dodder in alfalfa, and Canadian and sow thistle in miscellaneous samples of grains and grasses. The Pure Seed Laboratory has also co-operated and been associated with the field inspection work relative to the field work with flax, Durum wheat, and Brome grass. Special arrangements have been made for the inspection of Durum wheat, Brome grass and flax. Field inspectors were out during parts of June and July, visiting such farms as they were requested to, and examining the fields as to purity, thus giving opportunity for the listing of seeds of high quality.

ALFALFA TRIALS

The principal work in connection with alfalfa has been breeding for winter hardiness, the comparison of the effects of various cultural methods, the effect of seeding with and without a nurse crop, and the effect of third crop cutting upon the following crops of alfalfa. The trials at this Station up to the present time have shown the Grimm strain of alfalfa much superior in withstanding winter conditions to other strains that may be used in the state. The superiority in hardiness of the Grimm has been indicated in so many trials at this Station and at the Sub-Stations that there is no question but that at the present time the

Grimm variety is the most hardy and the safest strain of alfalfa to seed in North Dakota.

Some exceptionally good yields of alfalfa hay were secured. During the past year as high as seven tons of alfalfa per acre were cut from a large trial plat in three successive mowings. This piece of land went into winter quarters with but little growth, and in the spring showed that from fifteen to eighteen per cent. of the plants were either killed or very weak. Later, during the very favorable spring weather, the plot made an excellent growth and showed full recuperation from the injury sustained. Evidence is accumulating to show that care must be used in making the last cutting of alfalfa, particularly if it is cut later than the first of September, as under unfavorable weather conditions much loss may result. It is not known whether this loss is due to the weakening of the plant from the late cutting or failure to produce sufficient growth to protect the plant during the winter. The fact of possible injury, however, remains.

The yellow flowered alfalfa or falcata variety has been under observation at this Station for several years. It gives no promise of especial value in this section of the state.

CLOVER

Extensive trials in the production of Medium Red, Alsike, White, and Sweet clover have been continued during the past year. That part of the state lying within the Red River Valley and extending a few miles westward in the northern part of the state, is well adapted to the production of Medium Red clover. Outside of this section, the Medium Red clover cannot be recommended, and may very well be replaced with alfalfa or by Sweet clover. The trials upon the depth of seeding Medium Red clover have been completed. The results strongly indicate the importance of shallow planting. Trials have also been completed as to the thickness of seeding the different kinds of clovers. The medium seedings apparently give better results when all factors are taken into consideration. Some marked results have been obtained from extremely thin seeding. One seed of White clover within fourteen months formed a plant which was four feet across. The Medium Red, Mammoth, Alsike, and White clover are practically limited to the eastern counties of the state for successful culture.

Trials of Sweet clover are giving promising results for the entire state. It withstands more drouth than the other clovers and a stand may be obtained under much more severe conditions. As it is a biennial plant, it is much better adapted to a rotation of crops than alfalfa, which is its principal competitor. Trials now in progress indicates that the Sweet clover will prove very advantageous to sections of low rainfall in the western part of the state and to areas in which land blows badly or where it is difficult to get a stand of alfalfa. Its production of forage is equal to alfalfa in ordinary years and in years of low rainfall, exceeds that of alfalfa.

PLANT BREEDING

Owing to the poor drainage facilities on the Experiment Station grounds, the breeding work and field crop trials were suspended for the current year, during which time a complete tile drainage system has been put under all land that is devoted to field crop experiment plats. The records of the Station show that during the history of the institution, field crop trials have either been annulled or seriously interfered with one year in five by excessive water. It was therefore considered good policy to eliminate this element of risk by sacrificing a year's results. A small area of land which had been tile drained a few years ago was devoted to ear-to-row corn work. This, however, was the only cereal work carried on. It is expected that the work will be reorganized the coming year. Many cereal varieties will be discarded and the plant breeding nursery organized upon a new basis.

SOIL FERTILITY

The soil fertility trials previously in progress have been continued without interruption. The tile drainage system which was put in during the year was laid out so that the mains and laterals were placed in the alley-ways between the fertility trial plots and thus permitted the tiling to be carried on without interfering with the fertility trials. These experiments show that under conditions which have prevailed during the past several years, stable manure is worth in added crop production from $1.40 to $1.65 per load, and that the effect of stable manure and of a change in crops becomes more marked as the land grows older.

The fertility trials are planned to show the effect of the various fertilizers and combination of fertilizers in the production of crops upon the heavy soils of the Red River Valley. During the next ten years there are possibly many sections in the Red River Valley which will feel the effect of decreasing fertility. The broad question that will be answered is, What elements of fertility are required to prevent deterioration in the productive capacity of the soil? These trials compare the livestock system of farming and the grain system of farming, indicating the elements of fertility which will be required to maintain each system. The general fertility trials are duplicated on the Sub-Station farms at Edgeley and at Langdon. Thus, a very definite answer to the question of need and effect of commercial fertilizers upon soil and crops will be obtained in the future.

A number of years must necessarily elapse before conclusive results so far as the main studies are concerned are obtained. The results of crop rotation and the relation of crops to each other as reported in Bulletin 100 of this Station have been supported and supplemented by data secured since its issue. This data becomes of increasing importance as time goes by, for it may be expected that many of the rotations will show decreasing values as the land becomes older. Several of them which gave relatively high yields in the first few years of work may be expected from now on to give decreasing returns.

The maintenance of the fertility of the soil of the farms of the state is of the greatest importance. Chemical analyses and trials all indicate

that the North Dakota farmer must soon take cognizance of the draft that the single cropping has been making upon his soils and that we must rapidly adopt systems of farming which will involve crop rotation, the use of livestock, and possibly later the application of certain elements of fertility.

NEW SALEM BREEDING CIRCUIT

The New Salem Breeding Circuit is carried on in co-operation with a number of dairy farmers in the vicinity of New Salem, and the U. S. Department of Agriculture. Its purpose has been to develop the feature of co-operative breeding, and the use of superior livestock among farm groups. The close of the fiscal year completed five years of work. This project has developed slowly. Some progress has been made, however, in determining the sires of progeny of high performance and arranging for exchanges between circuit owners. The circuit members have arranged to set aside five per cent. of the income of sales of stock made to be used as an advertising fund for the benefit of the circuit. Some attention has also been given to the showing of their best cattle. Nineteen head were exhibited at the Missouri Slope Fair in 1914. The following data indicates the number of cattle which comprise the circuit and their records:

Number of pure bred cattle in circuit	205
Number of pure bred females in circuit	163
Number of cows making requirement of seven-day official test	7
Number of cows making requirement of semi-official yearly test	1
Percentage of pure bred cows giving 300 lbs. of butter fat or over per year	60

PASTURING OF NATIVE RANGE GRASSES

A project was instituted by the North Dakota Experiment Station in co-operation with the Federal Great Plains Station at Mandan, N. D., for the purpose of determining the value of the native prairie grasses from a pasture stand point, and the possibilities of the substitution of grasses. Two hundred and fifty acres of land have been set aside for the purpose of this experiment. This area is divided into pastures of thirty, fifty, seventy and one hundred acres, respectively. Ten head of two-year old grade beef steers are to be placed in each pasture, which will make a carrying capacity trial of three, five, seven and ten acres per head. Counts of the flora will be made each year to determine definitely the reduction which has taken place in the grass plants under the different rates of pasturing. As the native grasses are displaced or killed out, new forage plants will be seeded for the purpose of determining varieties which may be used to replace the native grass.

This problem is becoming an important one in many sections of the state. The earlier settlers are beginning to find that the rough or grass lands set aside for pasture do not have the carrying capacity that they formerly had. Thus, the pasture area is becoming decreasingly valuable from year to year. The importance of this project may be farther indicated by the fact that the U. S. Department of Agriculture states that seventeen per cent. of the area of North Dakota west of the 100th Meridian is pasture land. This constitutes a total of 4,253,226

acres. If grasses and forage plants may be found or developed which can be used in increasing the pasture capacity of this land, this project will be of great economic importance. During the past year, the area was grazed down to make a uniform condition to continue the trial in the spring of 1916. It is anticipated that this trial may extend over a series of several years.

ANIMAL HUSBANDRY

The principal studies in Animal Husbandry during the past year have been in pasturing trials for pigs. The extremely wet season has prevented satisfactory results from being recorded. The trial paddocks formerly used have been refenced, and the system extended by the addition of new paddocks so that facilities for work in future will be better than heretofore.

A sheep feeding trial to study the economy of feeding alfalfa hay at the Williston Sub-Station required a large part of the Animal Husbandman's time during the fall months. It is planned that the Animal Husbandry work, especially along lines of trial feeding, shall be developed at all of the Sub-Stations.

During the year, the dairy barn was occupied and a monolithic and a cement stave silo were constructed. A sanitary milk house was also built. The grade of livestock which is maintained at the Station has been very greatly improved this past year by the addition of sires and the culling out of inferior stock. The plans for the future contemtemplate the operation of a dairy plant with representatives of the Holstein, Guernsey, Jersey and Red Polled breeds. The beef plant will carry herds of Shorthorns and Angus, while the principal breeds of sheep and swine will be maintained.

SUB-STATIONS

Plans of work in relation to the Sub-Stations have been materially revised. The principal changes consist in curtailing the cereal crop trials and investigations and developing the livestock interests. At the Edgeley Sub-Station, swine breeding, the feeding off of forage crops, and the hogging down of corn have been instituted as the chief features of the livestock trials. Alfalfa, Sweet clover, cereals and rape are being used as pasture crops.

Due to the fact that the Williston Sub-Station is located upon the Williston Irrigation Project, much attention is to be given to the methods of livestock husbandry which will utilize alfalfa and other forages grown on this project. A carload of Montana range lambs were purchased during the fall and fed out. One lot was fed on alfalfa hay alone, as compared to the other lot fed on alfalfa hay and screenings. The gains and profits as obtained from the latter lot were much greater than the profit of the lot fed on alfalfa hay alone.

At the Langdon Sub-Station a grade horse-breeding trial has been successfully completed, and the present plan is to discontinue it and put in a herd of Shorthorn cattle as a similar project for the future.

A herd of dairy cattle were placed upon the Hettinger Sub-Station shortly after the Station was started. The dairy cows are now supplemented by a suitable herd of hogs. The cereal and rotation work is much less extensive than at the other Sub-Stations, as the work at the Dickinson Sub-Station precludes the necessity of a strong study of these lines at Hettinger. During the year, arrangements were made with the Office of Dry Land Agriculture, to co-operate in this work by furnishing a Sub-Station Superintendent. Subsequently, Mr. William R. Lanxon resigned as superintendent, and was replaced by Mr. Arthur J. Ogaard.

The work at the Dickinson Sub-Station continues to be largely with the various varieties of cereals and of grasses. Work instituted is of such importance that it has not been deemed advisable to make the changes which would include the production of livestock upon this farm.

A rotation trial with flax production as a central object has been instituted at the Williston, Langdon and Hettinger Sub-Stations and at the Experiment Station at Fargo. This trial has now been under way two years. The importance of maintaining the flax crop acreage in North Dakota is generally recognized, and this trial instituted to ascertain a method of cropping and cultivation which will make the production of this crop on old land a success. The dry land rotation experimental work which was begun at Edgeley is being continued at the Edgeley, Dickinson, Williston and the Hettinger Sub-Stations. The results of the past year's work have been summarized and published in Bulletin 110. This experiment has given data which leads to the following conclusions:

1. Climatic conditions are the chief determining features to crop production in western North Dakota.
2. The amount of rainfall during the growing season more largely determines the crop production than the annual rainfall.
3. Available records show the average frost free period to be at Edgeley, 129 days; Williston, 119 days; Dickinson, 110 days.
4. While stored water may be of value in supplementing rainfall, it is unable in itself to mature a crop in western North Dakota.
5. Prevention of the growth of weeds is a much more important function of cultivation than is the maintenance of a mulch.
6. Summer tillage has value in assurance against crop failure. It has not increased average yields over those obtained by other methods enough to warrant giving it more than a temporary place in any system of agriculture in the state.
7. The application of barnyard manure has shown marked results.
8. Neither fall plowing nor spring plowing has a marked advantage when compared for a series of years.
9. Discing corn stubble land is as good preparation for the succeeding crop as plowing.

DEMONSTRATION FARMS

Twenty-two Demonstration Farms were operated during the season of 1914-1915. Contracts are now in force for twenty-one farms to be operated during the season of 1916.

The rotations on the several farms have been carried out the past season as previously planned. The results obtained from the operation of the rotations upon the Demonstration Farms strikingly indicate the value of proper rotations in North Dakota's agriculture. During the past year the fields on the Demonstration Farms yielded an average of 30.8 bushels of Durum wheat per acre, and 29.8 bushels of hard wheat. This yield is 65 per cent. greater than the average yield of wheat in the state. Oats averaged 58.5 bushels per acre; barley 37.9 bushels, winter rye 21.4 bushels. Corn yields were practically a failure in every section of the state except the southern. The yields on farms were very low. Mature corn was produced on eleven farms with an average yield of 23.4 bushels per acre. Fodder was produced on twenty fields, with an average yield of 2,517 pounds of air dry fodder per acre. This is the lowest yield of corn and fodder that has been secured for several years. Excellent stands of alfalfa were obtained during the crop year of 1914 by seeding with small grain as a nurse crop at Hoople, Hazelton, Beach, Mohall, Ross and Sanborn. During the spring of 1915, alfalfa was seeded with small grain as a nurse crop at ten points. Good stands were apparently secured at six points. Alfalfa which was seeded in rows for seed production has produced very fair crops. Hay production has given splendid returns. The average from the Demonstration Farm fields in 1915 was a trifle over two and one-half tons of air dry hay per acre.

Sweet clover that had been seeded on three farms, namely, Granville, Beach and McLeod, in 1914, made an excellent growth at Granville and McLeod where the soil is sandy. A good crop of hay was produced at each of these points, also a good crop of seed. The Sweet clover at Beach winter-killed during the winter of 1914–1915. A field of Sweet clover seeded at Hazelton in 1913 produced a good crop of hay and seed in 1914. During 1915 the field which had been reseeded from seed shelled out during 1914, was pastured by hogs. The hogs seemed to prefer the Sweet clover to alfalfa where they had a free range of both crops.

Demonstration Farm meetings were held at ten of the farms in the summer of 1915. Due to bad weather conditions the attendance was much smaller than in previous years. An average of ninety-five attended at each meeting. At these meetings, the rotations were discussed and studies were made of the various farm products, covering cultural methods that had been used during the preceding three or four years.

AGRICULTURAL EXTENSION

The discovery of a practice valuable to agriculture or of methods which will increase the profits of the farm or better the rural conditions, is of little value until it becomes a matter of common knowledge and usage among the people of the state. The Agricultural Experiment Station is organized primarily to make discoveries and to work out methods. The Department of Agricultural Extension is organized to take these discoveries and methods to the people of the state and make them a matter of common knowledge and practice, or to accumulate the results of successful farm practice and disseminate them. It is only in this way that agricultural facts can be made of great value to the state.

The most effective method of spreading knowledge of important practices and inducing their use in large numbers of communities is by means of demonstrations. It is for the purpose of making contacts with the people of the state that the Extension Service has been formed. This service comprises men and women who are skilled in presenting agricultural fact and information and who can aid the farmer in applying this information to his farm conditions. In addition to the giving out of information relative to farm practices and the farm home, the Extension Department must carry on the many lines of work which grow out of special agricultural problems, or which are closely related to the advancement of the agricultural interests of the state. The organization of work with the boys and girls so as to induce an interest in the possibilities of the farm and home; the organization and leadership of farmers' clubs that will bring about a greater community cohesiveness and co-operation; the assistance in agricultural fairs and agricultural meetings, with many other lines of work, all are a part of the duties of the Extension Department.

The organization for this work is centered at the Agricultural College, but the work itself must be carried out in the various sections of the state as closely in contact with the rural communities as is possible. The effectiveness of the work and of its organization is determined largely by the number of places that are reached and the resulting changes in farm practices that are induced.

SMITH LEVER ACT

The passage of the Smith Lever Act in 1914 placed the Agricultural Extension work that is in progress in North Dakota upon a firm financial foundation. This Act gives direct assistance to all states for Agricultural Extension work and nationalizes the Extension activities. It is far reaching in effect, and assures a definite program of Agricultural Extension work that cannot fail to bring about tremendous results within

the state. The Act as passed by Congress eventually makes an annual appropriation of $4,580,000.00 for Agricultural Extension Work in the United States. The appropriation for 1914 was $480,000.00, or $10,000.00 to each state. It was increased by $600,000.00 in 1915, and thereafter for seven years is increased by the sum of $500,000.00 a year until the permanent appropriation reaches the sum previously stated. The basal appropriation to each state is $10,000.00 annually. The additional appropriation as based upon the additional sums appropriated by the Federal Government is to be apportioned to the states in the proportion that the rural population of each state bears to the total rural population of the United States. The final appropriation as made becomes available in 1922. At that date, upon the basis of our present rural population, North Dakota will receive $52,607.00 per annum. The basal appropriation of $10,000.00 annually is made to each state which "by action of its legislature assents to the provisions of this Act". The additional sums appropriated annually by the Federal Act must be off-set by an equal sum of money appropriated by the state, county, or local authority. Thus, providing the proportion of population remains the same, North Dakota in 1922 must provide at least $42,607.00 to meet the annual appropriation as made by this Act. The maximum appropriation is reached in the fiscal year of 1922, and after that year the appropriation remains fixed until changes in the rural population as indicated by the Federal Census may provide for a change in the relative sums received by each state. The last legislature in North Dakota assented to the provisions of the Smith Lever Act, and appropriated the necessary funds to meet the increased Federal appropriation during the years 1915 and 1916. Additional appropriations will be required for 1917 and 1918.

The Act further provides that the Agricultural Extension work shall be in co-operation with the Department of Agriculture, and that the work shall be carried on in such manner as may be mutually agreed upon by the Secretary of Agriculture and the proper officers in the states which receive the benefit of the Act. This tends to bring about a uniformity of Extension work within the states, and necessarily provides for a program which will be comprehensive, constructive, and which will not permit the wasting of funds. The expenditure of funds in this state obtained from the Smith Lever Act and from the off-setting appropriations made by the state, will for the coming three years, be largely upon the following projects: County Agricultural Agents, Home Economics, Boys' and Girls' Club Work, and Farm and Livestock Management. As additional funds become available, it is planned to increase the number of County Agricultural Agents at the rate of two or three a year. The remainder of the funds will be used in instituting such new projects as are necessary to the work or increasing the specialists who are engaged in carrying on the present projects.

ORGANIZATION OF EXTENSION WORK

The Agricultural Extension work as organized in North Dakota covers three rather distinct fields of operation; namely, the County Agricultural Agent, the General Extension Specialist, and the general office

and informational service. Co-operation with counties in supporting County Agricultural Agents requires the largest proportion of Extension funds at the present time. It is expected that the County Agricultural Agent will be the basis of the Agricultural Extension activities within the state. This project is carried on in co-operation with the several counties in the state. The field men engaged in the work are located at convenient points in the county and their work is definitely concerned with the development of the agricultural resources of that county. They are the resident representatives of the Agricultural College and Experiment Station, but promote those lines of work in which the counties are most interested and have the greatest need.

The general Extension specialists are located at the central office and travel from one part of the state to the other to assist in various lines of Extension work. They are available to every section of the state. In counties where County Agricultural Agents are employed, they are especially valuable in assisting to develop interest in the lines of work in which they have specialized. Under the general Extension work is also carried on the industrial contests, the boys' and girls' clubs, the work with farm women and the rural home, preparation of exhibits at fairs, and such special agricultural meetings as may be demanded in the state. The Extension workers also represent the force that is available to assist individual groups of farmers in problems in which they may be interested.

The general office is organized primarily for administrative and executive purposes. The general reports of the field workers are kept at the office, plans are worked out which provide for uniformity in carrying on the work in the state, and the general arrangements made for the development of the various phases of Agricultural Extension work as it may be needed in the state. The handling of the funds, the budgeting of the projects and supervision of all forms of the work are centered in this office. In addition, the distribution of bulletins and of informational literature is carried on through this office. During the present fiscal year approximately $7,170.00 will be expended for the general office charges; $55,246.00 for County Agricultural Agent work; $5,900.00 for Home Economics; $6,010.00 for Boys' and Girls' Clubs, and $5,930.00 for work in Farm Management.

The number of specialists engaged in Extension work has been limited on account of the funds available. The principal lines of work for the past year have been the industrial contests and the boys' and girls' clubs. The industrial contests among the rural school children as previously organized have been continued with increasing results. During the past year, 12,000 boys and girls entered contests in the various counties. These contests comprise corn, alfalfa, potatoes, bread-making, sewing, and butter-making. The contests are organized in the various counties through co-operation with the County Superintendents of Schools. The Extension Department furnishes the outlines for the work that is to be carried on, and so far as possible furnishes judges for the contests which close the work in the county each year. In December of each year, after the various county contests have been decided, the boys and girls who have won prizes are given through their County

Superintendents a special trip to the Agricultural College, where four days are spent in a meeting which will bring out the various features of agricultural and home life in a way that will be of benefit to them.

Such assistance is given in the carrying on of agricultural meetings as is possible. Last year, assistance was given at eighteen short-courses held within the state. Much assistance was also given the Farmers' Institute. The Extension Department furnished the time of Miss Newton to the Farmers' Institutes to talk on household affairs.

EDUCATIONAL TRAIN

The Extension Department supervised in co-operation with the Soo Line, the operation of a Livestock Demonstration Train. This train visited thirty-seven points in North Dakota on the Soo Lines, with a total attendance of thirteen thousand seven hundred and sixty. The train carried a car of livestock which was used for demonstration purposes at the various stopping points. The results of the operation of the livestock demonstration train were apparent. Much interest was aroused in livestock, and the following winter special Livestock Institutes were held at the points where the train had stopped. These Institutes had an attendance practically fifty per cent. greater than the average of the other Institutes held in the state.

FARM INFORMATION SERVICE

The informational service as carried on through the Extension Department is concerned chiefly with the printing of bulletins and circulars issued either through the Extension Department or the Experiment Station, and in sending out a weekly informational service to the rural press, the daily papers, and the agricultural papers. In 1914 and 1915, the Agricultural Editor issued one extension poster, and previous to August, 1914, prepared copy and illustrations for a farm page which was used by the Western Newspaper Union and the American Press Association. Since August, 1914, this service has been discontinued. Short articles are prepared weekly for the state papers and for the agricultural press. These articles, which deal with various farm and home topics, are sent to all papers in the state that have indicated that they would use them. One hundred and fifty weekly papers use short articles which are sent out, and one hundred and nine use both short and long agricultural articles. The weekly papers are divided into two sets, so that different material is sent to each paper when there are two papers in a town. Eleven daily papers are also supplied with a service which covers such special agricultural news as is issued through the Experiment Station. In addition, sixty-six agricultural papers receive this service. The papers which have the greatest circulation in North Dakota are supplied with a service which pertains to special agricultural problems that are brought up from time to time.

It is difficult to place a value upon the Farm Information Service. Checks have been instituted at various times to determine the use that was being made of the articles sent out. Recently, during one week it

was found that thirty-seven per cent. of the papers used from one to three of the articles that were forwarded from the office. In another week, fifty-six per cent. of the papers made use of from one to three of the articles. In a third week, thirty-six per cent. used from one to three of the articles, and in a fourth week, seventy-six per cent. made use of the articles. Very often the articles are not used at the time they are sent or in the form in which they are sent out, but are changed in such a way as to make a special article for that paper. Through the Farm Information Service, agricultural material as issued by the institution is made available to practically every citizen of North Dakota.

HOME ECONOMICS

The work in Home Economics has developed slowly. Since September, 1914, one woman has been engaged in this work. Beginning September, 1915, the Home Economics Section of the Extension Department was organized for the purpose of employing specialists who would be of direct assistance to the farm woman on problems relating to the farm home. It is contemplated that this section of the work will be increased as rapidly as there is demand for it. The present plans provide that work during the coming year will be carried on largely through short-courses and special meetings for the farm women.

COUNTY AGRICULTURAL AGENTS

The work of the County Agricultural Agent now appears to be firmly established in North Dakota counties. This year closes the fourth year of continuous work. Many of the present force of County Agricultural Agents have been employed in their counties for this entire period. The progress made by these counties during the four years is plainly evident, and definitely proves the value of the County Agricultural Agent. This progress has been not only along material lines, in the increased diversification of the agriculture of the district and the increased acreage of alfalfa, corn, etc., but is even more evident in the general attitude and progressiveness of the farm people. The statement is very often made by public workers that the greatest alertness and knowledge of farm problems and farm conditions is shown in those counties which are employing County Agricultural Agents. This seems evident not only in relation to farm problems but also in relation to the many local problems which affect the farm or the farm home.

Interest in this form of work does not appear to lag. During the past two years the lack of sufficient funds has prevented the same rapid increase of work which took place in previous years. Applications from counties not employing County Agricultural Agents are taken care of as rapidly as arrangements can be made for the financing of the work and competent men obtained. Under present conditions, not to exceed two or three counties can be added annually to those which are receiving the benefit of funds from the institution.

The County Agricultural Agent is employed co-operatively by the Board of Regents, as representing the Department of Agriculture, and

the County Commissioners of the various counties. Previous to January 1st, 1915, one-half the cost of employing an Agent in the county was borne by funds supplied through the institution or through the Department of Agriculture. Beginning January 1st, 1915, a change in the method of financing the work was necessitated by the condition of the funds available. Since that time, the institution has either through its appropriations from the Smith Lever Act or by direct appropriation from the Department of Agriculture, supplied $1,000.00 annually for each man employed in a county. The remainder of the salaries and expense of the work has been paid by the County Commissioners. It is contemplated that as rapidly as financial considerations will allow, the amount paid by the institution will be increased to $1,200.00 or $1,400.00 per annum for each man.

So far as possible, the work is continued in counties upon the basis of the definite co-operative agreement between the Board of Regents and the Board of Commissioners, extending over a period of two to three years. The agreement essentially provides that the Board of Regents shall employ a competent County Agricultural Agent to carry on work within the county and that he shall be satisfactory to and approved by the County Commissioners. The direction and supervision of this work rests with the Board of Regents. Reports of the work and of expenditure of funds are filed with the Board of County Commissioners, and their advice and help is solicited in the carrying on of the work. Additional co-operation is provided through the Department of Agriculture. In this manner, the work in each county is carried out co-operatively by the Board of Regents, as representing the State, the Department of Agriculture, and the County.

COUNTIES CO-OPERATING IN THE WORK

The following counties co-operated in the employment of County Agricultural Agents in 1914:

County	Agent
Adams	R. D. Laflin
Barnes	Edwin Mayland
	T. X. Calnan
Bottineau	A. P. Henderson
	W. E. Wied
Bowman	T. E. Mills
Cavalier	J. W. Haw
	T. T. Kristjanson
Dickey	W. B. Richards
Eddy	W. H. Burns
Grand Forks	O. D. Center
	Edgar Olsen
Hettinger	J. R. Campbell
LaMoure	J. M. Humphreys
Velva District, McHenry County	L. H. Robbins
Pierce	E. H. Hall
Ransom	O. O. Uhlhorn
Steele	A. E. Nelson
Stutsman	A. F. Borchert
	J. W. McNary
Ward	W. A. Peck

Wells	A. J. Gaumnitz
	T. E. Clarke
Williams	E. W. Hall

December 1st, 1915, the following counties were co-operatively employing County Agricultural Agents:

County	Agent
Adams	R. D. Laflin
Barnes	Edwin Mayland
	T. X. Calnan
Benson	H. J. Boyts
Bottineau	A. P. Henderson
Cavalier	J. W. Haw
	T. T. Kristjanson
Dickey	W. B. Richards
LaMoure	J. M. Humphreys
McKenzie	M. B. Johnson
Morton	A. J. Gaumnitz
Pierce	E. H. Hall
Ransom	O. O. Uhlhorn
Renville	G. W. Wood
Steele	A. E. Nelson
Stutsman	A. F. Borchert
	J. W. McNary
Towner	B. A. Gray
Walsh	Paul Carpenter
Ward	W. A. Peck
	G. C. Edwards
Williams	E. W. Hall

During the fiscal year 1914–1915 work was discontinued in a few counties. In Bowman County work was discontined the first part of 1915. This work had been supported by private funds and it was thought advisable to discontinue this support. Work was discontinued in Eddy County caused by the resignation of the Field Agent. He was not replaced during 1915, although funds were available for the continuance of the co-operation. The work in Hettinger County was discontinued upon the resignation of the County Agricultural Agent the latter part of December, 1914. Upon the expiration of the contract with the business men of Velva, co-operative field work was discontinued in that district. Wells County failed to appropriate funds for the continuance of the work after August 1st, 1915. The agents employed were transferred to other fields. Grand Forks County which had co-operated in the work for a period of three years discontinued co-operation in December, 1914. Since that time, the Grand Forks County Better Farming Association has carried on the work and furnished full financial support.

SPECIFIC WORK OF COUNTY AGRICULTURAL AGENTS

The work of the County Agricultural Agent may be roughly classified into three great divisions; namely, field demonstrations, general advisory work in relation to the farm, and the holding of general meetings, agricultural short-courses and schools. In developing the County Agricultural Agent's activities in North Dakota, it is aimed to establish the greatest possible number of demonstrations in each territory and to use the demonstrations in calling attention to improved agricul-

tural methods and the possibilities of the adoption of the principles and practices as demonstrated upon the farms of the county. The demonstration work of whatever form becomes a definite line of work which the County Agricultural Agent carries out, and in a large grouping comprises the general project of the work. The problem of the farmers of North Dakota has largely been that of diversification—the development of the livestock industry, the growing of feeds, etc. Consequently, the same general group of work is carried out in each county. The details as to the various practices and methods are determined by the conditions that prevail locally, but the constructive development of the same general project which has to do with the building up of the soil, the rotation of crops, the use of livestock and the production of forage crops, is carried out in each county. This provides a method by which the state as a whole may benefit from the activities of the County Agricultural Agent. Although his efforts are confined to the one county, the influence of the practices followed is invariably reflected in adjoining counties.

SUMMARY OF LEADING ACTIVITIES OF COUNTY AGRICULTURAL AGENTS, 1914

Farmers' Clubs organized	175
Shipping and Selling associations	19
Value of business carried on through associations	$60,400
Farmers' meetings held by Agents	974
Total attendance at meetings	81,197
Farmers called at office	6,354
Visits made to farm co-operators	18,596
Others visited on farms	8,573
Co-operative demonstration fields established	1,866
Acreage in co-operative demonstration fields, acres	18,245
Acreage in alfalfa and sweet clover demonstrations, acres	6,865
Acre Yield Corn Contest, contestants	688
Pork Production Contest, contestants	364
Boys' Schools and Encampments held	3
Livestock Breeding Circuits organized	13
Silos constructed	181
Seed corn saved, bushels	35,892
Alfalfa seed distributed, pounds	90,000
Pure bred sires introduced	649
Livestock introduced	1,702
Average number of Agents for the year	22
Number of counties	18
Total cost of work	$54,942.78

The above table summarizes the leading lines of work that have been carried on by County Agricultural Agents in 1914. Particular attention should be given to the large number of farmers and farm homes that have evidently been reached by the County Agent. Definite co-operative demonstrations of soil and crops were carried on with one thousand eight hundred and sixty-six individual farmers. This constitutes farmers who have signed an agreement to carry out some continuous form of co-operative work upon their farm. In addition to these men, six thousand three hundred fifty-four farmers called upon the Agents for advice, and eight thousand five hundred and seventy-three who were not co-operating for a definite period of time have been visited on their farms.

Many lines other than those indicated have been carried on. All, however, have definitely to do with some one of the agricultural problems with which the farmers of the state are concerned.

The cost of county agricultural agent work as a method of reaching the individual farm and inducing changes in farm practice is relatively low. If consideration is given only to work which has been carried on definitely with some one farm, the average cost per farm reached has been slightly under $3.30. The cost per demonstration in 1915, of the total cost of work charged against the demonstration, was slightly under $16.00. Each definite and continuous demonstration may easily be utilized by ten to fifteen surrounding farmers, and in many instances it is definitely known has affected 1,000 to 1,500 acres of contiguous farm land. If people reached through farm meetings are taken as a basis, the cost is approximately 50 cents per person. The work in any county from an economic view point gives a return in actual practice of from ten to fifty times the annual cost of the work in that county. For example, Stutsman County shipped 150 cars of stock the first year that the County Agent was employed. After the work had been in progress two years the annual shipments amounted to 281 cars. Bottineau County was credited with growing 2,000 acres of corn the year previous to the arrival of the County Agricultural Agent. After four years of work the acreage is estimated at 50,000, again far in excess of the general gain in the state or in counties not employing Agents.

The specific demonstrations as carried out in the state number 2,691. Based upon a general grouping, the following represents their distribution of June 30, 1915:

DISTRIBUTION OF DEMONSTRATIONS JUNE 30, 1915

Rotation plots	71
Hog pastures	56
Alfalfa plots	1,003
Miscellaneous problems relative to soil and crops	733
Ground squirrel extermination	64
Demonstrations relative to livestock	520
Miscellaneous demonstrations relative to farmers' organizations, the home or farmstead	244
Total	2,691

A complete summary for the year 1915 with results of the work cannot be given in the present report. For the year to December 1st, 942 meetings with an attendance of 95,947 were held in the counties of the state. 7,449 co-operators were visited and 7,077 farmers called at the office of the Agents for assistance. The work of the current year was fully as successful as in the previous year. A noticeable increase has been made in the number of farmers calling upon the Agents for assistance and in the number who are taking up the working out of the general agricultural problems as applied to their neighborhood.

RESULTS OF FIELD DEMONSTRATIONS

The field and plot demonstrations of crops have again shown the results of better seed, better tillage and better methods of handling the

soil. While the results from these demonstrations are not presented as showing conclusively the full value of crop rotation and the best methods of handling crops, yet they are an indication of the possibilities of better forms of tillage and of crop rotation.

SUMMARY OF ACREAGE AND AVERAGE YIELD PER ACRE ON DEMONSTRATION PLOTS AND FIELDS—1914

Crop	Acreage Acres	Average Yield Demonstrations Bu.	Average Yield Adjoining Fields Bu.	Average Yield State Bu.
Corn	4,583.69	34.35	26.95	28.0
Wheat	3,204.98	16.55	11.36	11.2
Oats	870.11	31.92	25.44	28.
Barley	620.33	26.83	18.93	19.5
Rye	355.00	20.8	11.21	17.1
Flax	185.58	9.10	8.38	8.3
Alfalfa	6,475.28	1.78 T.	1.61 T.	.....
Potatoes	58.13	102.08	81.88	109.

HOG CHOLERA CONTROL

Coincident with the development of the swine industry, many losses occurred in 1914 from hog cholera. The losses were exceptionally heavy in the southeastern section of the state. In this section each County Agricultural Agent arranged so far as it was advisable, to give demonstrations in the control of hog cholera through the use of preventive serum, and organized clubs among the farmers for the holding of the serum against emergencies and the joint employment of veterinarians where necessary. During this season, eleven thousand seven hundred and fifty hogs were vaccinated for cholera either directly by the Agents or at their request. Approximately eighty per cent. of the hogs vaccinated survived the attack of cholera. The loss of hogs in the herds vaccinated approximated twenty per cent. The general practice in this work has been to give as large a number of demonstrations in a county as was necessary to convince the farmers of the value of the use of preventive serum. Attention was then given to the organization of farmers to combat the disease themselves, either through quarantine regulation or by having on hand a stock of serum, after which time it was expected that they would make use of the local veterinarian. The work in Dickey County along this line was exceptionally valuable, as the County Agricultural Agent through organization for quarantine and through determined propaganda for vaccination, practically prevented the spread of the cholera outside of the eastern and central section of the county.

WORK IN RELATION TO LIVESTOCK DISEASES

The County Agricultural Agents have frequently been requested to assist in eradicating various livestock diseases other than hog cholera, and in advising as to treatment. Their services have been especially in demand relative to the treatment for black leg. In 1914, seven hundred

head of cattle were treated for black leg with the vaccine furnished by the federal government. In cases where the treatment was given by the Agent, the farmer was instructed as to methods of vaccination and given information so that in the future he might obtain the vaccine and administer it. Somewhat similar work has been carried on in relation to the testing of cattle for tuberculosis. While the tests have in most instances been made by veterinarians, the Agents assisted and frequently induced the farmers to arrange for these tests. Due to the efforts of the County Agricultural Agents, three hundred and eighty-four head of cattle were tested for tuberculosis in 1914.

SEED CORN

The seed corn campaign in the fall of 1914 for the saving of home grown seed was very successful. A greater amount of seed was saved in the state than in any previous year. This was partially due to the fact that there was better organization in the counties, and also to the fact that there was a large amount of corn produced in nearly every section that would make high grade seed. A total of thirty-five thousand eight hundred and ninety-two bushels of seed corn was saved directly through the activity of the County Agents. It was estimated that an equal amount was saved in these counties by parties with whom the Agents may not have come in contact. This quantity of seed, with seed that was saved in other sections of the state, was sufficient for the sowing of the corn acreage in North Dakota in 1915. Unfortunately, the year was one in which late frosts in the spring and early frosts in the fall killed the greater part of the corn in the state, with the result that in spite of the most strenuous efforts for the saving of seed corn, a smaller quantity is on hand for the spring of 1916 than for three years past.

The importance of home grown seed corn can scarcely be overestimated. The experience of farmers and the results obtained from the Boys' Acre Yield Corn Contest show in every instance the superiority of good home grown seed over varieties which may be brought into the state. The saving of seed corn is a feature of the work of the County Agricultural Agent that must be vigorously pushed from year to year until a sufficient supply of home grown seed is obtained to take care of the wants of the state for at least one year in advance.

ALFALFA

The acreage devoted to growing alfalfa in the state has steadily increased since 1911. Careful estimates made at the close of 1915 indicate that at least one hundred thousand acres of alfalfa are now being grown in the state. This crop is so important in any program of diversification that each County Agricultural Agent has given a great deal of attention to the establishment of alfalfa demonstrations and the securing of a wide adoption of the production of this plant. In 1914, ninety thousand pounds of alfalfa seed was distributed among farmers who wished to increase their acreage. This seed was secured from sections which produced a quality of seed that seemed to be especially adapted

to the needs of the sections of North Dakota where it was to be grown. The seed was distributed at cost. Farmers have continued to increase their acreage of Grimm alfalfa. Much of this acreage is sown in rows, primarily for the purpose of seed production. Within the near future, North Dakota will produce its own seed supply of Grimm alfalfa, and within a comparatively few years, have a surplus for sale to other states. Up to the present time, North Dakota farmers who have established good seed fields of Grimm alfalfa have been able to secure splendid and remunerative markets. The demand for this seed is apparently increasing rather than decreasing.

SWEET CLOVER

The Sweet clover demonstrations have been continued, especially in the drier sections of the state, and in sections of the state where the land is sandy or is inclined to blow. Sweet clover has proven that it is better adapted to the conditions named than alfalfa. It is easier to secure a stand, and forage is produced in greater quantity. Several of the demonstration fields of Sweet clover were killed during the winter of 1914–1915. This, it is thought, was partially due to the extremely dry fall and to the open weather conditions that prevailed. The general results as obtained from the Sweet clover demonstrations are such that increased acreages will be sown this coming year. Farmers are becoming convinced of its value as a forage and pasture plant. It is not considered that Sweet clover displaces alfalfa, but that in some sections it may be better adapted to cope with the conditions than is alfalfa. Sweet clover is proving important on sandy lands where a short rotation is necessary and where the production of Medium Red clover has generally been a failure.

COW TESTING ASSOCIATIONS

Voluntary groups have been formed among farmers in several of the counties for the testing of their dairy cows for production. The County Agricultural Agents have made all the tests required and returned the necessary records. The Testing Association organized between Wimbledon and Leal in 1913 was continued under the supervision of the County Agricultural Agent but without additional cost to the Association. This Association has developed a great interest in improved dairy cattle among its members, and is definitely demonstrating the value of improved stock in the community. During 1914 four hundred and forty-nine cows were tested for production.

MARKETING AND PURCHASING

Nineteen associations were formed in 1914 among farmers for the purpose of marketing their livestock or other products. The greatest attention, however, has been given to the problem of livestock marketing. In many localities in the state, there are no livestock buyers, or at least they come into the locality but seldom. The formation of marketing associations has met a need and provided for the regular marketing of

the livestock from the community at a cost which has been very low. These associations are growing slowly and carrying on a work which is necessary to the community. They have frequently marketed other products than livestock. Alfalfa seed, potatoes, and farm seeds of various kinds have been marketed through these associations. The total business as carried on through them in 1914 amounted to $60,400.00. As Farmers' Clubs bring about a greater confidence among the people in a community it may be expected that substantial shipping associations will be formed which will either act independently or co-operate with the farmers' elevators or similar co-operative enterprises.

The organization of these associations has been largely due to the County Agricultural Agents. They are operated and officered, however, by members of the association elected by the community. The County Agricultural Agents will engage in giving assistance along lines of marketing and the organization of marketing associations as rapidly as investigations of the Department of Agriculture and the Experiment Stations furnish definite information. At the present time more definite information is needed as to the principles which govern successful marketing organizations and the marketing of miscellaneous farm products. Until these principles are determined, associations must develop slowly, as success will not be possible unless the basic principles are correct. The problem of the marketing of farm products, particularly those growing out of the diversification of the farming industry in North Dakota, is of great importance. Successful diversification cannot be practiced unless the disposal of the products is also arranged for. It is believed that the development of shipping or similar associations will easily take care of the various products of diversification which may be produced upon the farm.

WORK WITH BOYS AND GIRLS

County Agricultural Agents supervised and co-operated in carrying on the Boys' Encampment which was held at the Grand Forks Fair in 1914 and the encampment held at the Valley City Chautauqua the same year. In these encampments, one hundred or more boys were brought in for a week to a ten-day period for agricultural instruction. The lessons are given in the form of demonstrations and much attention is paid to local farm practices and to the judging of livestock. The boys live in tents, are furnished with their own commissary department and are under military supervision. They thus obtain a pleasant outing, and in addition gain some knowledge of progressive agriculture. In 1915 a Boys' encampment was again held at the Valley City Chautaugua. This was attended by 113 boys. The courses of instruction were largely connected with livestock judging and feeding and the problems relating to the organization of the farm and the care of the soil.

FARM BOYS' HIKE

A boys' hike was held in Williams County the summer of 1915. Forty-seven boys spent a week in going from one selected farm in the county to another, studying the various features of the farm that were

of importance and gaining from their instructors as well as the farmers, inspiration as to what a better agriculture may mean. On this hike, particular attention was given to the livestock interests and to the production of feed and forage crops.

BOYS' SHORT COURSES

A very successful boys' winter school has been carried on for the past three years for a period of six days in connection with the Mid-Winter Fair at Minot. The school in 1914 had an attendance of eighty-six boys. In 1915 a similar school was held with an attendance of one hundred and thirty farm boys. Arrangements were made to house them in public buildings and to spend from four to six hours per day in class work.

A somewhat similar school or short-course was held at Langdon in Cavalier County, in July, 1915. The course of instruction given at that point was adapted to out-door teaching and demonstrations, and dealt largely with the growing of crops and of livestock. A similar school was held the latter part of 1915 at Bottineau with an attendance of one hundred and eighty boys. Agricultural short courses for boys are rapidly growing in favor and offer an opportunity for specific instruction in agriculture which in many instances has a marked effect upon the boys' future in the country.

OBSERVATION TOURS AND FIELD EXCURSIONS

A large number of observation tours were held in various counties where Agents are located, for the purpose of giving information as to the effect of certain practices. These tours have been found especially potent as applied to the development of silo construction, the use of livestock, and the value of crop rotation. The general plan of the tour is to arrange for automobiles to carry from fifty to one hundred farmers, visiting a number of places which have features which the leader desires to bring out. In a silo tour, for example, farms may be visited which will show each type of silo construction. Each farmer has an opportunity to examine the silos carefully and to discuss with the owner its advantages or disadvantages. Similarly, a tour for the observation of rotation plots may, if carried out at the proper season of the year, show definitely the value of the rotation compared with other cropping systems. Or in the instance of livestock tours, a lesson on the best methods of caring for stock and the value of the different classes of stock from a productive stand point may be conveyed with much less effort than with any other form of instruction.

The farmers of Williams County, and part of Ward County, led by the County Agricultural Agents, have taken observation tours upon a larger scale. Arrangements were made for a special train or special cars which would carry a group of farmers to some of the older agricultural states. From a few hours to a day were spent at a number of different points, studying the effect of the farming practices as carried on in that locality, and especially the methods of caring for and handling

of livestock. These excursions have invariably resulted in inspiration for better farming, and the feeling that the application of business methods to the farm will enable the North Dakota farmer to cope with any situation which may arise.

ACRE YIELD CORN CONTEST

The third annual Acre Yield Corn Contest was conducted in 1914 under conditions similar to that carried on in 1913. Its purpose was to demonstrate the possibilities of high yields of mature corn in every section of the state. Six hundred and eighty-eight boys entered the contest. Each boy was required to grow at least one acre of corn. Many of them grew several acres. The yields of mature corn that were produced were exceptionally high and were of splendid quality. Statistics of yields and averages follow:

ACRE YIELD CORN CONTEST—1914

Highest yield mature corn per acre, southern section	98.8 bushels
Highest yield mature corn per acre, northern section	76.4 bushels
Average yield mature corn prize winners, southern section	70.6 bushels
Average yield mature corn prize winners, northern section	62.3 bushels

A boy in Ransom County, Walter Granlund, produced the highest yield of mature corn in the state, 98.8 bushels. The second highest yield was produced in Traill County. This contest has again demonstrated the possibilities of corn growing in the State of North Dakota, and the fact that the careful selection of seed, with proper tillage methods, and the use of farm manures, will give highly profitable corn yields within the state.

A similar contest was carried on in 1915. The climatic conditions for the year were so severe that corn as a crop was almost a failure in the state. A freeze in the late spring coupled with frost in August, destroyed the value of the corn crop over large areas of the state. In spite of these conditions, many of the boys who entered the contest succeeded in producing excellent yields. Their yields of this year are of exceptional importance as indicating the possibilities of the crop under the most unfavorable conditions. The results were as follows:

ACRE YIELD CORN CONTEST—1915

Highest yield mature corn per acre, southern section	90 bushels
Highest yield mature corn per acre, northern section	50½ bushels
Average yield mature corn prize winners, southern section	47.8 bushels
Average yield mature corn prize winners, northern section	38.9 bushels

PORK PRODUCTION CONTEST

A Pork Production Contest similar to the one instituted in 1913 was continued in 1914 under practically the same conditions. The object of this contest was to point out the fact that pork could be produced cheaply with the farm feeds that are available in the state, and that under ordinary farm conditions, pork could be profitably produced.

Prizes were awarded to those in the contest who produced the largest amount of pork in the shortest time from the litter at the lowest cost. Feeds were charged at average farm prices. The average feed cost of producing pork as demonstrated by the winners in the contest of 1914 was 2¾c a pound. The winning contestant produced 3811 pounds of pork at a feed cost of $91.49 and a return over feed cost of $156.22 for the litter.

The contest was again continued in the year 1915. A higher price was made for farm feeds, and the loss of the corn crop, particularly from the stand point of giving opportunity to hog off corn, materially increased the cost of production. The average feed cost per pound as indicated by the winners in the contest was 2 2-3 cents.

FARMERS' CLUBS

The organization of Farmers' Clubs throughout the counties has continued. Encouragement of such organization is considered of great importance. The difficulty in solving many of our agricultural problems is caused by lack of rural organization. It is believed that the Farmers' Club offers the best method of developing community co-operation and leadership. At the present time there are five hundred Farmers' Clubs in North Dakota. They have a combined membership of at least ten thousand farm families. The influence which these clubs may have upon the community and the agricultural progress of the state is tremendous. The mere fact that they meet once or twice a month to discuss the problems of the farm and the home means that a very large number of people are applying their best thought to the betterment of the agricultural interests. Suggestive programs of work and courses of reading are sent out by the Extension Department. Every effort is made through both the County Agricultural Agents and other public agencies to assist the clubs in holding attractive meetings and in obtaining information on subjects in which they are interested.

MISCELLANEOUS

Many additional forms of work that assist the farm community have been carried on. Details of this work, while of interest and importance, are beyond the limits of this report. The County Agricultural Agent assists, so far as possible, in every enterprise which will benefit the farm group or the individual. A mere incident of this detailed work, for example, is the supplying and distribution of farm labor. During the past year, the County Agricultural Agents have placed over ten thousand laborers among farmers. Attention has been given to home problems, sanitation, building construction, pit silos, locating markets, preparing programs for meetings, securing seed, interchanging livestock, developing community interest, assisting in co-operative enterprises, bringing town and country to a better mutual understanding, assisting superintendents and rural school teachers, assisting at county fairs, etc.

CONCLUSION

In a report of this character, few of the activities of the Extension Department may be detailed. Attention is called only to features of the work and organization which are timely and of apparent state importance. The future of Agricultural Extension work and the benefit to the state must be determined to a large degree by the substantial farmers and business men of the state. It is the policy of the organization to develop new lines of activity and work as rapidly as consistent with the demands. It is the duty of the Experiment Station to discover and work out methods, and that of the Extension service to popularize and induce the use of these methods.

PUBLICATIONS

The following bulletins and circulars have been issued during the past year:

Bulletin No. 109: December, 1914—"Report of Four Years' Work of the North Dakota Holstein Cattle Breeding Circuit", by J. H. Shepperd and W. B. Richards.

Bulletin No. 110: February, 1915—"Dry Farming Investigations in Western North Dakota", by John C. Thysell, Dickinson; H. C. McKinistry, Hettinger; R. S. Towle, Edgeley; Arthur J. Ogaard, Williston; Assistants in Dry Land Agriculture U. S. Department of Agriculture.

Bulletin No. 111: March, 1915—"Tomatoes for North Dakota", by H. O. Werner.

Bulletin No. 112: May, 1915—"Fertility and Weeds", by J. W. Ince.

Bulletin No. 113: May, 1915—"Report of Progress in Sugar Beet Trials", by J. W. Ince.

Circular No. 2: November, 1914—"Report of Progress in Sugar Beet Trials", by J. W. Ince.

Circular No. 3: December, 1914—"Preliminary Report of the Mammals of North Dakota", by Vernon Bailey, William B. Bell and Melvin A. Brannon.

Circular No. 4: January, 1915—"Extermination of Ground Squirrels, Gophers and Prairie Dogs in North Dakota", by William B. Bell and Stanley E. Piper.

Circular No. 5: February, 1915—"The Farmer's Vegetable Garden", by H. O. Werner.

Circular No. 6: April, 1915—"Early and Late Sowing of Flax; Growing Flax on Corn Ground; The Seed Field; Resistant Seed", by H. L. Bolley.

BULLETINS FOOD DEPARTMENT

Vol. III. No. 8: July, 1914—(1) Jamestown as we Find it. (2) Velvet Skin Cold Cream. (3) Investigation of Commercial Fruit Jellies. (4) Reduced Iron. (5) Some Varnish Troubles.

Vol. III. No. 9: August, 1914—(1) Hard Red Spring Wheats from the Demonstration Farms. Studies of Wheat Quality under North Dakota Conditions. (2) Fertilizers, Feeds and Fungicides.

Vol. III. No. 10: August, 1914—(1) Sanitation and Control of Bakeries. Meat Markets and Slaughter Houses in North Dakota. (2) The Baking Powder Situation. (3) Farmers' General Service Company. (4) Valley City as we Find it. (5) Foods and Beverages Analyzed. (6) Inspection for Hillsboro. (7) Fargo City Water Supply.

Vol. III. No. 11: September-October, 1914—Some North Dakota Cities as We Find Them.

Vol. III. No. 12: November, 1914—(1) The Sale of Undrawn Poultry. (2) Progress in Food Matters. (3) Bleached Flour. (4) Tobacco is Injurious to Boys. (5) The Drug Habit—Its Dangers. (6) Resolution Condemning Snuff passed by the W. C. T. U. (7) Ice Cream. (8) Spirits of Camphor. (9) Publicity in Food Work. (10) Disinfection of Rooms, Furniture, Clothing, etc. (11) Foods and Beverages Analyzed. (12) "W.B." Chewing Tobacco.

Vol. III. No. 13: December, 1914—(1) Sanitary Inspection of Cities. (2) Soap Bark and Saponin Prohibited. (3) Meat Markets—1914. (4) Saccharin in Foods and Beverages.

Vol. III. No. 14: January 1915—(1) Is the Present System of Grading Wheat Equitable? (2) Velvet Chaff and Durum Wheats. (3) Insecticides and Fungicides. (4) The Use of Paris Green and Bordeaux on the Farm. (5) Elixir Iron, Quinine and Strychnine Phosphate. (6) Foods and Beverages Analyzed. (7) Patent Medicine, Fakes and Quackery. (8) Congress Bitters.

Vol. III. No. 15: February, 1915—(1) Flour—Percent of Moisture and Variation in Weight During Storage. (2) A Further Study of the Variation in Weight of a Fifty Pound Sack of Flour During Storage. (3) Eaton's Liniment. (4) Klaussen's Hair Tonic. (5) Good Samaritan Ointment. (6) "544" For Hog Cholera. (7) Narcotics and Their Use. (8) Cereal Coffees. (9) Dugrest's Egg Producer. (10) Benefits From the Food Law. (11) Homogenized Milk and Cream. (12) Registrations for 1915.

Vol. III. No. 16: March, 1915—(1) Grocery Stores—1914. (2) Registrations for 1915. (3) Hog Cholera Nostrums. (4) The Bleaching of Flour. (5) Alaska Kidney Pills. (6) Dike's Hair Tonic. (7) Wine of Pomelo. (8) Meritol Tonic Digestive. (9) Dodd's Kidney Pills. (10) Herbola Tonic. (11) More About Fakes—Patent Medicines. (12) Fake Patent Medicines. (13) Meritol Colic, Cholera and Diarrhea Remedy. (14) Delano's Rheumatic Conqueror. (15) False Advertising. (16) Patent Medicines a Public Evil. (17) Slaughter House Plans. (18) More Quackery.

Vol. III. No. 17: April–May, 1915—(1) Thiele's Hog Cholera Remedy, "544". (2) The Chemical Analysis of Molasses. (3) A Comparison of the Value of the Four Types of Hard Red Spring Wheat, Namely, Marquis, Velvet Chaff, Bluestem and Fife. (4) Moisture in Flour.

Vol. III. No. 18: June 1915—(1) Ice Cream Warning. (2) Paragraphs. (3) Foods and Beverages Analyzed. (4) Oyster Broth Powder. (5) A Warning in Regard to Poisons. (6) Red Berried Durum. (7) Perrilla Seed. (8) Precipated Sulfur. (9) Puffed Wheat.

Paint Bulletin—Vol. I. No. 6—March, 1915—(1) Lessons from the 1906 Test Fence. (2) The North Dakota Paint Law and its Workings. (3) Analysis of Commercial Paints. (4) Method for Varnish Analysis.

Special Bulletin No. 6: Reprint May 1915—Food Law; Pure Drug Law; Adulteration of Dairy Products; Hotels Supply Pure Water; Adulterated Dairy Products; Weight, Measure or Count of Food Products; Legal Weights; Selling Adulterated and Unwholesome Food or Medicine; Distributing Drug Samples Prohibited; Adulteration of Oils; Adulteration of Paints; Paints to Comply with the Law; Hints and Guides to those Who Would Comply with the Pure Food Law, Drug and other Laws; Net Weight, Measure or Count; Preservatives Permitted; Candy; Canned Goods; Coffees, Cocoas, Etc.; Condiments, Spices, Etc.; Baking Powders and Other Leavening Agents; Ice Creams; Extracts; Meats, Etc.; Syrup, Molasses, Etc.; Vinegars; Beverages; Drugs and Patent Medicines; Rules and Forms for Labeling Jelly.

FINANCIAL STATEMENT

UNITED STATES APPROPRIATIONS, 1914–1915

RECEIPTS

	Hatch Fund	Adams Fund
	$15,000.00	$15,000.00
To receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1915, under acts of Congress approved March 2, 1887, (Hatch Fund) and March 16, 1906, (Adams Fund)	$15,000.00	$15,000.00

DISBURSEMENTS

Salaries	$14,324.76	$11,879.64
Labor	32.50	256.29
Publications	.....	.....
Postage and Stationery	.....	9.95
Freight and Express	.....	14.56
Heat, Light and Water	.....	.....
Chemical Supplies	.....	369.00
Seeds, Plants and Sundry Supplies	.....	115.32
Fertilizers	.....	42.10
Feeding Stuffs	.....	1,224.39
Library	.....	4.00
Tools, Implements and Machinery	.....	81.55
Furniture and Fixtures	.....	13.70
Scientific Apparatus	.....	321.06
Live Stock	.....	601.60
Traveling Expenses	.....	57.30
Contingent Expenses	.....	.....
Building and Improvements	642.74	9.54
Total	$15,000.00	$15,000.00

FINANCIAL STATEMENT

UNITED STATES APPROPRIATIONS, 1914–1915

RECEIPTS

	Smith–Lever Fund
	$10,000.00
To receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1915, under act of Congress approved May 8, 1914. (Smith-Lever Fund)	$10,000.00

DISBURSEMENTS

Salaries	8,870.27
Labor	
Publications	
Stationery and Small Printing	
Postage, Telegraph, Telephone	
Freight and Express	
Heat, Light, Water and Power	
Supplies	
Library	
Tools, Machinery and Appliances	
Furniture and Fixtures	
Scientific Apparatus and Specimens	
Live Stock	
Traveling Expenses	1,129.73
Contingent Expenses	
Total	$10,000.00

FINANCIAL STATEMENT

STATE APPROPRIATION, 1914–1915

RECEIPTS

	Extension Fund
To receipts from the State Treasurer as per appropriation for the fiscal year ending June 30, 1915. (Extension Fund)	
Balance on hand July 1, 1914	$ 3,589.33
By state appropriation	10,000.00
By local receipts	352.70
Total	$13,942.03

DISBURSEMENTS

Salaries	$10,185.52
Labor	224.15
Publications	540.36
Postage and Stationery	871.06
Freight and Express	1.32
Heat, Light, Water and Power	.....
Chemical and Laboratory Supplies	.....
Seeds, Plants and Supplies	389.08
Fertilizers	.....
Feed Stuffs	.....
Library	.....
Tools, Machinery Appliances	2.10
Furniture and Fixtures	34.15
Scientific Apparatus and Specimens	41.89
Live Stock	.....
Traveling Expenses	951.81
Contingent Expenses	11.50
Building and Land	16.80
Unexpended Balance June 30, 1915	672.29
Total	$13,942.03

FINANCIAL STATEMENT

COUNTY AGRICULTURAL AGENT PAYMENTS 1914–1915

RECEIPTS

	County Agricultural Agent Fund
To receipts from counties	$38,449.99
Total	$38,449.99

DISBURSEMENTS

Overdraft July 1, 1914	$ 1,322.13
Salaries	18,702.05
Labor	25.00
Publications	
Postage and Stationery	13.03
Freight and Express	
Heat, Light, Water and Power	
Chemical and Laboratory Supplies	6.62
Seeds, Plants and Supplies	11.99
Fertilizers	
Feeds Stuffs	
Library	
Tools, Machinery Appliances	789.76
Furniture and Fixtures	8.10
Scientific Apparatus and Specimens	
Live Stock	
Traveling Expenses	11,959.18
Contingent Expenses	87.00
Building and Land	3.00
Unexpended Balance July 1, 1915	5,522.13
Total	$38,449.99

STATE BOARD OF REGENTS

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HELEN J. SULLIVAN - - - - - - Boys' and Girls' Clubs
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